Interfacial Adhesion behavior of sputtered titanium thin films deposited onto steel substrates

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Abstract. The good mechanical properties and high bond strength between the coating and the substrate is one of the properties needed for an increased durability. These properties are highly dependent on several parameters such as the previously treatment received by the substrate before deposition also on physicochemical phenomena occurring at the interface during and after deposition under the effect of heat treatments. In the present paper, we have investigated the relationship between the nature and composition of steel substrates and their reaction with titanium coatings as well as its effect on the adhesion behavior. To avoid the failure of adhesion observed in recent work caused by the direct deposition of carbon as amorphous carbon or hydrocarbon species directly from the gas or from the plasma for deposition of TiC films on steel substrates, we have used a cathodic sputtering system for deposit pure titanium thin films onto 42MnV7 steel substrates containing 0.49% mass of carbon. After vacuum annealing at 400 to 1000°C temperatures range. The observations and results show the formation and growth of titanium carbide (TiC) proportionally with the annealing temperature, as well as a good adhesion of coatings with their substrates within the annealing temperature range between 400 and 600 ° C. In the case of the samples annealed at higher temperatures, the results show the cracking and detachment of coatings mainly at high temperatures as a result of a bad Adhesion. These observations are accompanied with strong diffusion of the steel alloying elements towards the external layers.

Key words: Interfacial Adhesion, Steel, Titanium**.**